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*EP 66-90*

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ON SOVIET BLOC ELECTRONICS INTELLIGENCE

28 November - 9 December 1966

TRENDS IN THE ELECTRONICS INDUSTRY OF THE USSR

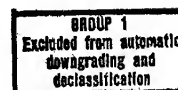
Prepared by the Electronics Equipment Branch  
of the Office of Research and Reports

November 1966

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This report was prepared specifically for use at the ██████████ Conference.

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Foreword

This paper presents a refined estimate of the size and composition of the Soviet electronics industry. Also included is an estimate of the value of electronic hardware produced for the new military programs which have been undergoing deployment since 1962, a statistical discussion of the growth rates of the industry in past years as well as prospects for further rapid growth in the future, and a comparison of the estimates of size of the US and Soviet electronics industries in 1965 and 1970.

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TRENDS IN THE ELECTRONICS INDUSTRY OF THE USSRI. Introduction

It should be stressed at the outset that verification of estimates of production of electronics equipment in the Soviet Union is becoming increasingly difficult. The USSR continues to maintain a high degree of secrecy about the activities of the electronics industry, and the flow of useful quantitative information has virtually ceased. In particular, data on the physical production of vacuum tubes and semiconductors, which provide a useful check on aggregate estimates, have not been released since 1961. On the positive side, output figures on consumer electronic items continue to be published as well as some value figures for the production of electronic computing equipment, and, more recently, some significant foreign trade information has become available through [REDACTED] official Communist sources. While some helpful generalizations can be drawn from these data, they are of only limited use in describing the movement of the total industry. From the standpoint of military electronics, sensitive new methods of intelligence collection have added a useful dimension to military-economic analysis. On the whole, official Soviet data on the electronics industry in recent years has been sparse.

The picture is only slightly brighter in respect to the availability of production indexes. Plan and plan fulfillment indexes continue to be published erratically for the industry as a whole and/or for some of its subsectors, but the loose and inconsistent terminology employed in stating indexes sometimes poses vexing problems for analysis. For example, according to a recent statement by Kalmykov, the output of the "radio industry" doubled during the seven-year plan. <sup>1/</sup> This index could refer (1) to the aggregate output of electronics equipment; (2) to the output of final assembly only; or (3) to the output of radio, television receivers, and other consumer items. Considering the immediate context in which the statement was made, its variance with all other published aggregate indexes, and the fact that the term had been equated earlier in a journal article to consumer electronics equipment, <sup>2/</sup> it is assumed that in this case the index refers to the consumer sector and is not an aggregate output index. A further note of ambiguity is contained in two additional references to the "electronics industry." In the first reference, the Minister of the Electronics Industry has stated that the rate of growth of the "electronics industry" increased by 1.5 times during 1965. <sup>3/</sup> From the context of his statement, it is believed that the Minister was referring to the output of his Ministry and not to electronics in the more aggregate sense. Since the Ministry of the Electronics Industry is responsible for the research, development, and production of electronic component parts (in contrast to the Ministry of the Radio Industry, which is responsible for the production of final goods), the term "electronics industry" in this case may be equated with the component sector of the industry. In the second reference, the journal Radio reported that the output of the "electronics industry" grew by 2.4 times during 1960-64. <sup>4/</sup> From context it is concluded that, in this case also, reference is made to the output of components. Fortunately, the problem of index identification, while vexing, has not proved unmanageable.

In the past, indexes which referred to the output of the electronics industry by its various designations such as the radiotechnical industry, the electronics industry, the radioelectronics industry have been found generally to be indexes of aggregate output -- the gross value of output of all electronics equipment. As such, they readily serve as a basis for production estimates. Aggregate output indexes subsume the output in the USSR of those electronic items which are nominally included within the conceptual framework of electronics output in the United States. They measure the growth in output of the whole industry in gross

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value terms, including all output of military/space electronics as well as expenditures on research and development. 5/ These indexes are assumed to be "commodity" indexes that are constructed by adding up the reported output of each plant but excluding the value of nonelectronic items -- for example, nonelectronic consumer goods, which might be produced as secondary output by an electronics plant.

In this paper, all aggregate value estimates are expressed in "net" terms -- that is, an allowance has been made for double-counting of components and for the relatively small value of output representing production equipment manufactured by the industry as a capital input into its own production process. In other words, aggregate value estimates represent the output of final electronics products only. One final caveat: estimates represent preliminary findings of continuing research and should be viewed as tentative.

## II. Background

The rate of growth of the Soviet electronics industry during the seven-year plan (SYP) is a crucial element in the analysis of its present size and composition. Given this datum, the gross value of output of the industry can be uniquely determined for 1965 and the military and nonmilitary shares of that output computed with a reasonable degree of confidence.

Three indexes which are available give rise to alternative hypothesis concerning the growth path followed by the electronics industry during the past seven years. First, there is the possibility that the original seven-year plan remained substantially intact, implying an average annual growth of about 17 percent. Second, there is the possibility, suggested by an official of Gosplan, that the growth rate actually declined in the final three years of the SYP to less than 15 percent per year (compounded). Finally, there is the position that output accelerated sharply during the final three or four years of the SYP raising the average annual growth rate for the period as a whole to about 22 percent. Analytically, the problem may be divided into two parts: (1) determining which path the industry actually followed and (2) determining whether, in point of fact, the goal was reached. In respect to the first point, it has long been the position of CIA -- presented at the [REDACTED] Conference -- that the industry was intended to grow by four times during the SYP. In respect to the second point, it is believed for reasons partly empirical and partly rooted in the dynamics of growth in Soviet defense industries that gross output during 1959-65 did, in fact, grow by four times. 25X1C

The original seven-year plan for the production of electronics equipment in the USSR called for a level of output in 1965 three times as great as that of 1958. 6/ When all available indexes are linked together, it appears that production grew at a relatively stable rate of about 16 percent a year (compounded) during the first three years of the SYP (1959-61). Allowing for some slight acceleration during the final four years as new capacity was phased in, this growth rate was entirely consistent with the programmed goal. In early 1963, Nelepo, an official of Gosplan, announced that output in 1965 would be "more than 50 percent greater than that of 1962." 7/ If assumptions about the growth in output up to 1962 are correct, this implied a falling off in the growth rate during 1962-65, indicating that the original 1965 output goal would be substantially underfulfilled. No meaningful interpretation can be attached to this index in the light of numerous press references to "accelerated" output during 1962-65 and, in particular, to the announced policy of the Communist Party. This policy, contained in a document late 1962 source clearly indicated that production was being pushed at a

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priority pace: "The program of the Communist Party calls for the forced production, in every way possible, of automatic lines and machines, automation equipment, telemechanics, electronics, and precision equipment." <sup>8/</sup> Moreover, the original SYP must itself be rejected as an indicator of the industry's true growth rate. Following the November 1962 Plenum of the Central Committee of the Communist Party, it became apparent that decisions -- ratified at this Plenum -- had been made to accelerate the electronics industry's output significantly. Explicit evidence of a revision in output goals was contained initially in the January 1963 issue of *Kommunist*, which announced that output of electronics equipment in 1965 would be four times that of 1958 -- that is, the 1965 target was increased by one-third over that of the original plan. Subsequent announcements by all leading officials of the electronics industry -- Kalmykov, Chairman of the State Committee of Radioelectronics; Kazanskiy, Deputy Chairman of the State Committee of Radioelectronics; and Shokin, Chairman of the State Committee of Electronics Technology -- repeated the index, each in his own way, making it unmistakably clear that the gross output of all electronics would increase by four times. <sup>9/ 10/ 11/ 12/</sup>

No new aggregative index has become available since the completion of the SYP to confirm (or repudiate) the fact that the output of electronics equipment in 1965 had reached a level four times that of 1958. On a less aggregative basis, it may be noted that the upward revision in the original plan for computers was fulfilled. <sup>13/</sup> Moreover, in the area of component production where one would expect a substantial expansion to support an expanded output of final equipments, there is evidence of accelerated growth, particularly in 1965. Production of components grew at an average annual rate of about 19 percent during 1960-64, compared with an estimated 24 percent for the industry as a whole. The rate of growth of components in 1965 was increased by 50 percent, implying an actual rate of growth in component production of about 29 percent during 1965 compared with an estimated rate of 30 percent for the industry as a whole. In addition, the output of semi-conductors in 1965 grew by 40 percent over 1964. <sup>14/</sup> (Interestingly, statistics for the United States electronics industry show a high degree of correlation in the movements of components and aggregate output, component production tending to grow at a rate only slightly below that of the aggregate) There are other evidences of a vigorous expansion of output of components. Soviet manufacturing facilities for component production equipment have expanded. In 1962 there were seven specialized plants manufacturing production equipment for the component sector. During 1962-65, four more plants were reportedly under construction. <sup>15/</sup> Moreover, imports of production equipment, principally from the Free World countries, have increased significantly in recent years. The Soviet foreign trade handbook for 1965 shows an expenditure during 1964-65 of about 23 million foreign exchange rubles on production equipment for the radioelectronics industry (most of which was probably allocated to the component sector). <sup>16/</sup> Imports of production equipment before 1962 are believed to have been negligible.

It is believed that the revision in output goals for electronics in 1962 was linked primarily to structural changes in Soviet military policy. A hint of this is contained in statements by Marshal Sokolovsky in the 1963 edition of his book on Soviet military strategy. Apparently referring to decisions made by the Central Committee of the Communist Party in 1962, he writes:

Suffice it to say that the entire fundamental reorganization of the Soviet armed forces, occasioned by the incorporation into them of nuclear and missile weapons, and of radio electronic gear, has been, and is being effected, on the basis of decisions of the Central Committee of the CPSU which made a scientific determination of the general line of development of modern weapons of war and of the probable nature of a future war between the camps of imperialism and socialism. <sup>17/</sup>

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More explicitly, it is believed that expanded output of electronics was needed to support incipient strategic military programs -- HEN HOUSE missile/satellite tracking facilities, the DOG HOUSE and TRIAD installations around Moscow, the TALLIN-type long-range aircraft interceptor facilities, and single-silo ICBM complexes.

### III. Production

Sufficient information is now available to write two simple equations that can be solved for the gross value of output in 1956 and 1965, thereby eliminating the need for many of the assumptions associated with previous estimates. In this case, only one assumption is used -- that the output of the Soviet electronics industry in 1965 was four times that of 1958. Official Soviet data used in setting up these equations are as follows:

- (1) The index of growth in the output of the electronics industry during 1956-65.

The output of electronics in 1958 was 1.48 times the output in 1956. A value of output in 1965 of four times that of 1958 provides an index of growth over the entire period 1956-65 of 5.92 times.

- (2) The gross value of output of the parent machine building and metal-working sector (MBMW) in 1956 and 1965.

The value of output of MBMW for 1965 has been announced as 61 billion rubles. <sup>18/</sup> The value for 1956 is derived by applying the official MBMW index to a published figure for 1955 and is determined to be 19.8 billion rubles.

- (3) The increase in the share of electronics in the gross output of MBMW during 1956-65.

According to Asval'dov, an official of the machine building industry, the share of electronics in the gross output of MBMW increased by 8 percentage points between 1956 and 1965. <sup>19/</sup>

It can be determined that the gross value of output of the Soviet electronics industry in 1956 and 1965 was 1.7 billion and 10.2 billion rubles, respectively.\* Adjusting for double counting of components, it is estimated that the "net" value of output -- the value of final goods and services -- in 1965 was 7.3 billion rubles (US \$10.5 billion). Although the current estimate of "gross" value falls no more than 10 percent below that presented at the [REDACTED] Conference, it is significantly lower in "net" terms. Lower net values derive from a much greater allowance for double counting than formerly.\*\*

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\* For mathematical solution and discussion, see Appendix A.

\*\* For discussion, see Appendix A.

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Annual levels of production of nonmilitary electronics (industrial and consumer) have been estimated from officially published data. Using the above values of aggregate output together with the estimated value of nonmilitary production, the size of the military sector of the electronics industry has been derived as a residual. The estimated structure of the Soviet electronics industry for selected years, in dollars and rubles, is given in Table 1. (Because of rounding, the total may not agree with the sum of the components).

Table 1

USSR:

Estimated Value of Output of Electronics Equipment by Major Sector of End Use,  
1958-65

		Billion US\$				
<u>Sector of End Use</u>	<u>1958</u>	<u>1962</u>	<u>1963</u>	<u>1964</u>	<u>1965</u>	
Military/Space/R&D	1.5	3.0	4.1	5.7	7.8	
Nonmilitary	1.0	1.8	2.1	2.4	2.7	
Total	<u>2.6</u>	<u>4.9</u>	<u>6.3</u>	<u>8.1</u>	<u>10.5</u>	

		Billion Rubles				
Total	<u>1.8</u>	<u>3.4</u>	<u>4.4</u>	<u>5.7</u>	<u>7.3</u>	

		Percent of Total				
Military/Space/R&D in percent of total	58	61	65	70	74	

#### IV. Growth of the Industry

The Soviet electronics industry, as official production indexes attest, has grown at an unusually rapid rate since 1950. According to a statement by Kazanskiy in 1964, "In the last decade the rate of growth of electronics was almost five times as great as the growth rates of most other branches of industry." <sup>20/</sup> This statement accords generally with what has been observed in official data. It is probable that, on the average, throughout the period 1950-65, the Soviet electronics industry has grown faster than any other major branch of industry in the USSR. During the SYP, output is believed to have grown at an average annual rate of about 22 percent. It is estimated that average annual rates on the order of 29 percent were achieved during 1963-65. Estimated average annual growth rates for selected periods are as follows (in percent):

1950-55	1956	1957	1958	1959-60	1961-65
35	29	23	20	16	24

Little is known about how the large expansion in output during the seven-year plan was accomplished. There is some evidence of expansion and renovation in existing facilities, and major new centers of electronics production are known to have been developing in the Baltic republics, in Belorussia, the Ukraine, and the Transcaucasian republics of Armenia and Georgia. If conditions in the electronics industry are assumed to have paralleled those in machine building as a

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whole, it may be postulated that one-half of the increase in output during 1959-65 was provided by existing facilities. This statement contains no important economic insight, however. More to the point, the accelerated importation of production machinery from the Free World and, indeed, expansion in the supply of domestically produced equipment may have increased the amount of capital per worker and, to the extent that the new capital embodied modern technology may have further increased labor productivity.

To a large extent, the fact of rapid growth is explained by two factors: (1) military priority and (2) the low technical requirements of the production process. The electronics industry in the USSR is oriented primarily toward the production and supply of military goods and services to the Soviet military establishment. In 1965, output of military electronics equipment constituted nearly 75 percent of the industry's output. With the preponderant share of output devoted to military purposes, it is clear that the growth rate of all electronics is highly sensitive to changes in military force levels or to changes in military technology. This sensitivity grows as complex weapons systems become increasingly electronics-intensive.

As a defense-associated industry, electronics is a high-priority claimant to available economic resources. Its technical requirements, however, are modest. Capital inputs are relatively small. It is estimated that only about 200 million rubles worth of production equipment had to be added to existing capital assets in 1965 to expand output by more than 1.5 billion rubles. Labor, the principal input, can be quickly trained and assimilated. On the basis of the fragmentary data available on labor force and productivity, it is estimated that the labor force of the Soviet electronics industry, including scientists, engineers, and technicians, more than doubled during the past five years, totaling at least 1.5 million in 1965, while output tripled. Hence, it may be inferred that about two-thirds of the growth in output over the past seven years can be explained by growth in the labor force and about one-third by increased labor productivity. The productivity of labor in the Soviet electronics industry appears to be much lower than in advanced Free World countries. This results from a combination of factors: (1) because of a deficiency of highly-automated equipment in component production, the capital-output ratio is low, implying a relatively large output per unit of capital -- that is, the Soviet component industry is excessively labor intensive; (2) Soviet production management is inferior; and (3) the Soviet industry was expanded so fast that production equipment of advanced design could not be supplied in sufficient volume, even with the assistance of substantial purchases from the Free World. (In the US industry the opposite appears to be true; gains in factor productivity -- increases in output per worker resulting from improvements in the efficiency of capital and managerial inputs -- has been the main contributor to growth in output.) Moreover, the supply of professional engineering manpower in the USSR appears to have kept pace with the overall growth of the electronics industry's labor force. The data base is tenuous, but available evidence indicates that during the past five years the higher educational establishments have been increasing the supply of engineers trained for employment in radioelectronic, electrical, and instrument-building fields, at an annual average rate of about 13 percent -- that is, at a rate corresponding roughly to what has been estimated for the growth of the labor force in the electronics industry as a whole.

#### V. Military Production

About \$40 billion worth of electronics equipment (military and nonmilitary) were produced in the USSR during the seven-year plan period. This is about US \$5 billion

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(or 14 percent) greater than would have been produced had the original goals of the seven-year plan been retained.\*

One of the basic premises of this paper is that this additional \$5 billion increment of output was needed during 1962-65 to meet the demand for electronics generated by programs the nature, scope, or timing of which were not envisaged by planners in 1958. More than 40 percent of this sum, or \$2.2 billion, can be associated with expenditures on "new" military programs; disposition of the remaining \$2.8 billion has not yet been ascertained. However, there is no evidence to indicate that nonmilitary production or conventional military programs entailed any significant alteration in expenditures on electronics from those originally programmed for 1959-65. It is suggested, therefore, that the unidentified residual represents expenditures on military and/or space-associated research and development activity, on expanded procurement for space, or possibly on procurement for military programs as yet unidentified.

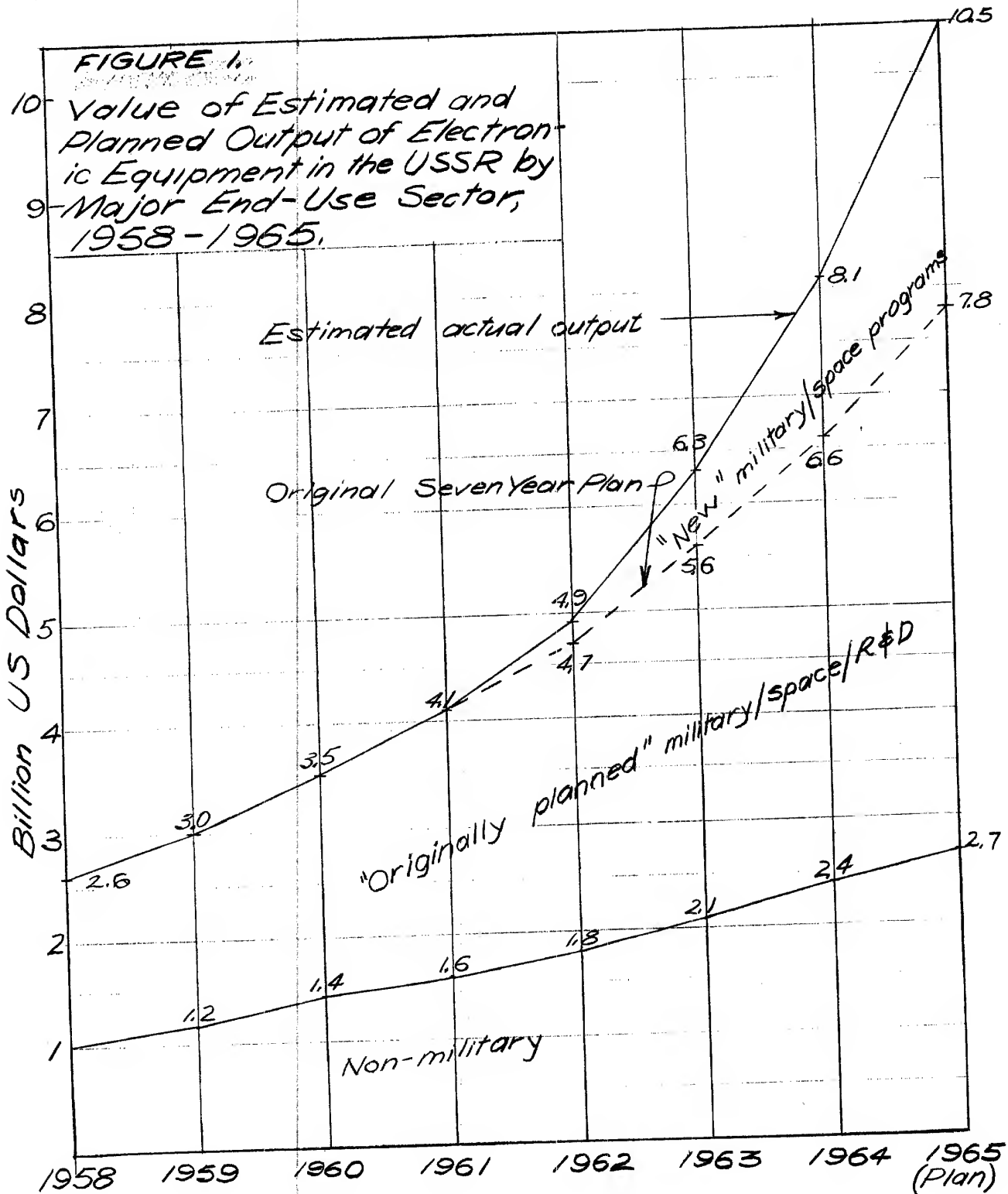
Figure 1 shows the growth in output of electronics, including military and nonmilitary shares, during the seven-year plan. The area labeled "new" military/space/R&D programs represents the difference between the estimated value of the original and revised plans for total output. The area labeled "originally planned" military/space/R&D represents dollars spent on the procurement of electronics for conventional military usages, for space hardware, and on associated research and development expenditures.

During the period 1962-65, about \$16 billion worth of electronics equipment was produced for conventional military programs, space, and R&D. Expenditures on electronics for conventional military programs include procurement for ground forces, navy, air force, strategic missile attack forces (MRBM's and ICBM's, excluding hardened single-silo complexes), and strategic missile defense forces (SAM's, excluding long-range SAM systems).

\* The magnitude of the difference between what was produced and what would have been produced under the original plan is a function of the actual growth rates for individual years. If output had grown along a four times path from the inception of the seven-year plan and if it grew at a steady compounded rate of 22 percent per year (compared with 17 percent compounded under the original plan), the total increase in output under the revised plan, relative to the original, would have been 33 percent.

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Estimated annual expenditures on electronics equipment for the new military programs are shown in Table 2.

Table 2

USSR:

Estimated Expenditures on Electronics Equipment for Identified  
New Military Programs, 1962-65

Million US\$					
Program	1962	1963	1964	1965	1962-65
HEN HOUSE*	7	48	92	48	195
Moscow TRIADS/DOG HOUSE	-	6	48	105	159
Long-range SAM	-	259	351	467	1,077
Single-silo ICBM (hard site)	-	68	216	460	744
Total	7	381	707	1,080	2,175

Taken as a whole, the production of electronics equipment for military/space/R&D during the period 1959-65 amounted to about 70 percent of the total volume of electronics produced. During the current five-year plan period, this share is expected to decline. Looking beyond 1970, it is likely that the needs of the public, industry, and the economy at large for electronic goods and services will force an increasingly larger share of resources to nonmilitary purposes.

#### VI. Prospects for Future Growth

By any standards, the Soviet electronics industry is large. In 1965 the value of output of final goods and services was more than US \$10 billion, or about 60 percent of that of the United States. The production of electronics for military/space/R&D, however, is estimated at about 90 percent of the US level. On the basis of current projections, it is unlikely that, in the near term, the Soviet electronics industry will draw abreast that of the United States in the aggregate output of goods and services. In terms of output of electronics for military/space/R&D, however, the prospects are much less sanguine from the standpoint of the Free World; by 1970 it is likely that the USSR will surpass the level of the United States. Figure 2 shows the estimated structure of the electronics industries of the United States and the USSR for 1965 and 1970.

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Since radar costs vary (nonlinearly) with power levels, any change in this parameter for the HEN HOUSE can significantly alter the estimate of the expenditure series for this program. The current estimate is based on a peak power of 13 megawatts;

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Under these conditions, preliminary investigations show that HEN HOUSE expenditures could be 25 to 50 percent greater than the figures shown above.

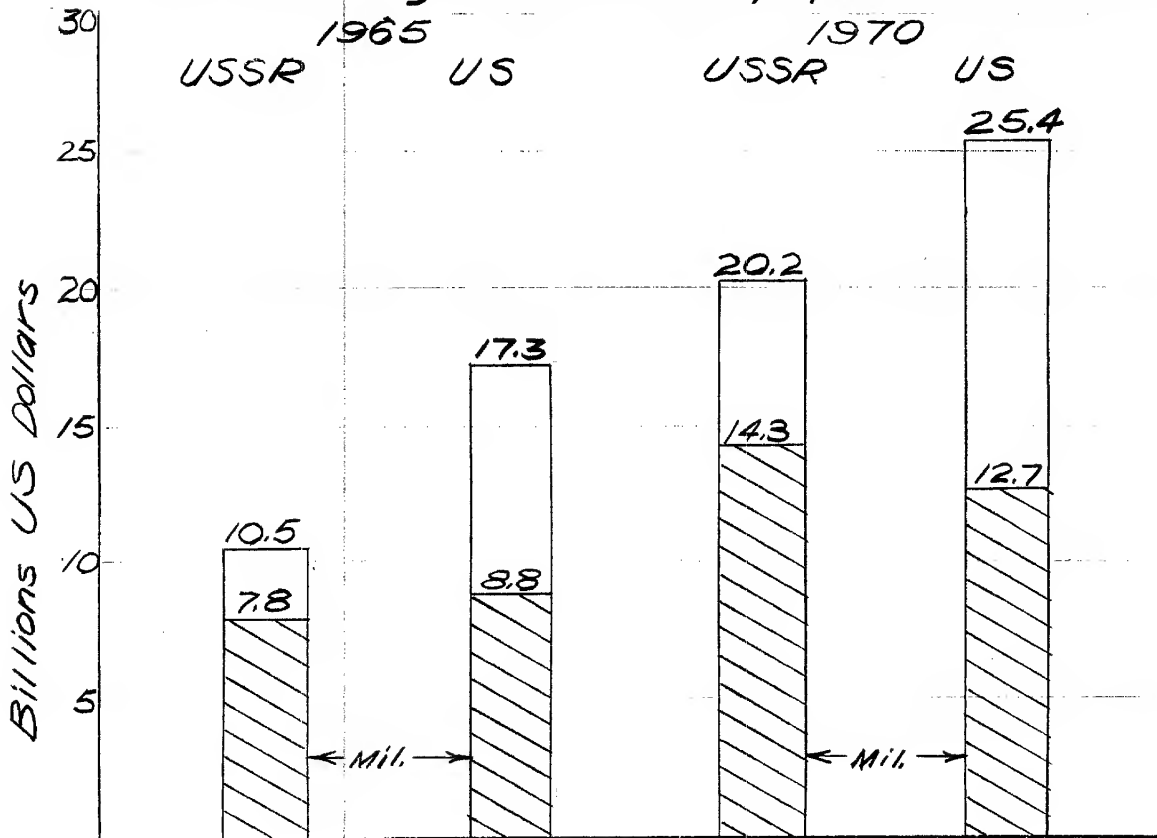
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Figure 2

*US and USSR:  
Best Estimate of Value of Output of Total  
and Military Electronic Equipment, 1965 and 1970*



Soviet growth rates have been projected out to 1970 on the assumption that the industry will revert to a rate more compatible with its secular growth pattern. The sharp upturn during 1963-65, as suggested above, is believed to have reflected exceptional short-term requirements. With production capacity in 1965 more than double that of 1962, it is believed that the need for accelerated levels of investment and growth in output on the scale of 1962-65 has abated. Substantially reduced growth rates during the post-1965 period should provide the industry with ample capacity to satisfy follow-on military requirements as well as growing demands for industrial and consumer commodities and services. Moreover, the apparent desire of the Soviet leadership to strive for a more balanced growth of industry generally during the current five-year plan period may also weigh against any sharp upturn in the growth curve of the electronics industry similar to that of 1963-65.

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It seems clear that output of electronics equipment will continue to grow at a priority rate. According to statements at the recent 23rd Party Congress: "The Five-Year Plan directives for 1966-70 provide for preferential development in the output of equipment for the electronics and radiotechnical industries 21/ ... "considerable growth of the electronics and radioelectronic branches of machine building is expected 22/ ... "during 1966-70, priority development of electronics is retained." 23/ On the basis of an earlier official statement that the output of electronics would grow "significantly faster" than machine building as a whole during 1966-70 24/ (machine building is scheduled to grow at a compounded rate of about 10 percent), a rate falling between 12 and 16 percent is believed reasonable, and the mid-point, 14 percent, has been selected as the best estimate. Similarly, on the basis of an examination of past trends together with official statements about the growth in output of some categories of consumer and industrial electronics, growth rates on the order of 15 to 20 percent for nonmilitary electronics through 1970 appear reasonable, and 17 percent has been projected.

The best estimate of growth in output of military electronics has been determined by the above constraints. On the basis of maximum assumptions about the growth of aggregate output of electronics equipment and minimum assumptions about the growth of the nonmilitary sector, it is postulated that during 1966-70 the military residual is unlikely to grow at a rate slower than 8 percent or faster than 16 percent. The implications of these rates relative to the question of the future intersection of growth rates of military electronics in the United States and the USSR are shown in Figure 3.

Projections for the United States assume a continuation of the current war-induced demands for military electronics equipment, a leveling-off of procurement and R&D expenditures for space purposes, and moderate outlays for an incipient ABM procurement program. Clearly, any widening of the war in Asia, announcement of new goals for space, or a major policy change in US strategic defense plans could impart a substantial upward bias to the projected US growth rate for military/space/R&D. Growth for the United States and the USSR for the recent past and projected through 1970 are shown in Figure 3.

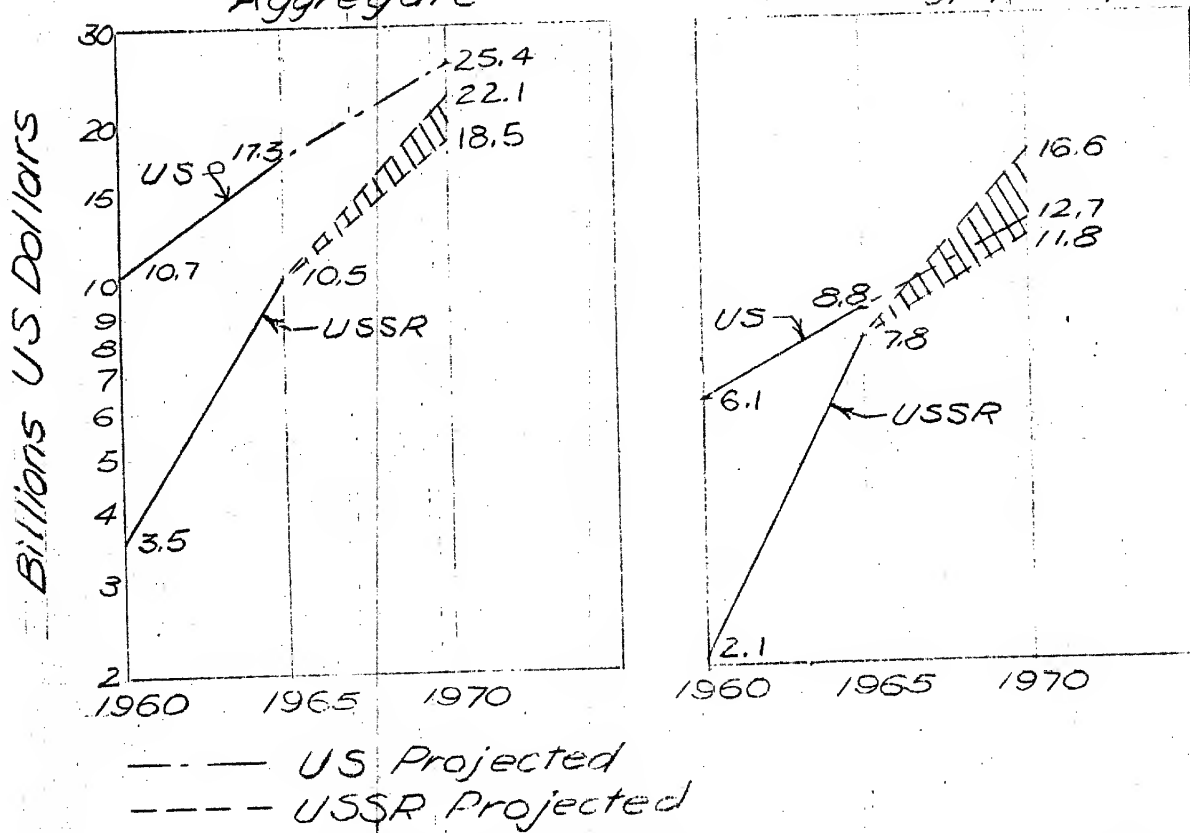
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Figure 3  
US and USSR:

Growth in Output of Electronic Equipment,  
1960-70  
Aggregate Military/Space/R&D



a. US rate based on data of Electronics Industries Association. The position of the curves is understated by the relatively small amount of military in-house R&D, which is not included. However, the slopes of the curves are not appreciably affected by the omission.

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APPENDIX A1. Derivation of the Gross Value of Output of Electronics in the USSR for 1956 and 1965

The statement by Asval'dov that the electronics industry's share of output in MBMW increased by 8 percentage points between 1956 and 1965 yields the following formulation in words and symbols.

The share of electronics in the output of MBMW in 1965 -- equals the share of electronics in the output of MBMW in 1956 -- plus eight percentage points,

or:

$$\frac{X_2}{61.0 \text{ billion rubles}} = \frac{X_1}{19.8 \text{ billion rubles}} + .08$$

Where  $X_1$  = gross value of output of electronics in 1956

$X_2$  = gross value of output of electronics in 1965

19.8 billion rubles = gross value of MBMW in 1956

61.0 billion rubles = gross value of MBMW in 1965

Another measure of output in 1965 compared with 1956 is provided by linking the following indexes: Output in 1958 was 1.48 times 1956. Output in 1965 was estimated to be 4 times 1958. Thus output in 1965 is 4 times 1.48 (or 5.92) times output in 1956. This relationship is expressed as:

$$X_2 = 5.92 X_1$$

Simultaneous solution of these algebraic formulations yields unique values for the output of electronics in the USSR for 1956 and 1965.

25X1C

2. Derivation of Net Value of Output of Electronics

It has become apparent, in the intervening period [REDACTED] that the previously estimated "net" value of output of electronics was probably too large; an unusually large volume of military electronics output, especially in recent years, could not be accounted for by existing "price and count" techniques and was inconsistent with other intelligence estimates of Soviet military expenditures. It is now believed that insufficient allowance was made for double counting.

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The estimated "net" value of output of the Soviet electronics industry in 1965 is 7.3 billion rubles, compared with 9.5 billion rubles presented at the last [REDACTED]. In part the lower "net" value derives from the use of a lower "gross" but the major source of the divergence is in the allowance made for double counting of components. In this paper, that allowance has been maximized through the use of a constant ratio (gross over net) of 1.35. This ratio has been derived from comparison with the US electronics industry over the period 1950-60, when levels of production, generally speaking, correspond with those in the USSR during 1956-65. In the United States the average ratio throughout the period was about 30 percent, declining from 35 percent in earlier years to a little more than 20 percent in later years of the period. The higher ratio of 35 percent is believed to be the most suitable analogue, at least for recent years, owing to contrary tendencies in the Soviet and US electronics industry. Whereas in the US large producers of end-equipment are becoming increasingly associated with the production of components (to reduce costs), thus tending to reduce double counting; in the USSR an opposite tendency has been noted. (increasing specialization of component production is being promoted, thus tending to increase double counting).

The use of 1.35 as a gross-to-net ratio has the following economic meaning: if all components are counted twice, the "gross" value of output will exceed "net" by 35 percent; it implies a structure of industry such that all production is neatly compartmented into producers of "end-equipment" and producers of "components". Of course, neither the electronics industry in the United States nor that in the USSR is so neatly structured. An indeterminate amount of component production is accounted for by producers of end-equipment and is not double counted. A possibly offsetting factor is double counting of interplant transfers of subassemblies, for which no explicit allowance is, or can be, made.

Since the above ratio is viewed as a maximum, it follows that the estimated output of military electronics equipment, derived as a residual, is likely to be a minimal figure.

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25X1C

25X1A

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